# Quality Assurance Project Plan (QAPP)
# for
# Indicator Bacteria Monitoring
# at
# Public Bathing Beaches


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# QUALITY ASSURANCE PROJECT PLAN

## 1. Title and Approval Page

**Indicator Bacteria Monitoring at Public Bathing Beaches**
(Project name)

**Connecticut Department of Environmental Protection Bureau of Water Management Planning and Standards Division**
(Responsible Agency)

**February 14, 2003**
(Date)

**Bureau QA/QC Officer Signature** [signature]

**Name/Date** Fred Banach, 2/24/2003

**Project Manager Signature** [signature]

**Name/Date** Ernest Pizzuto, 2/24/2003

**USEPA Project Manager Signature** [signature]

**Name/Date** 5-2-03

**USEPA QA Officer Signature** [signature]

**Name/Date** Lawrence MacMillan / Alan Peterson
May 2,2003

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# 2. Table of Contents

## 3. Distribution List

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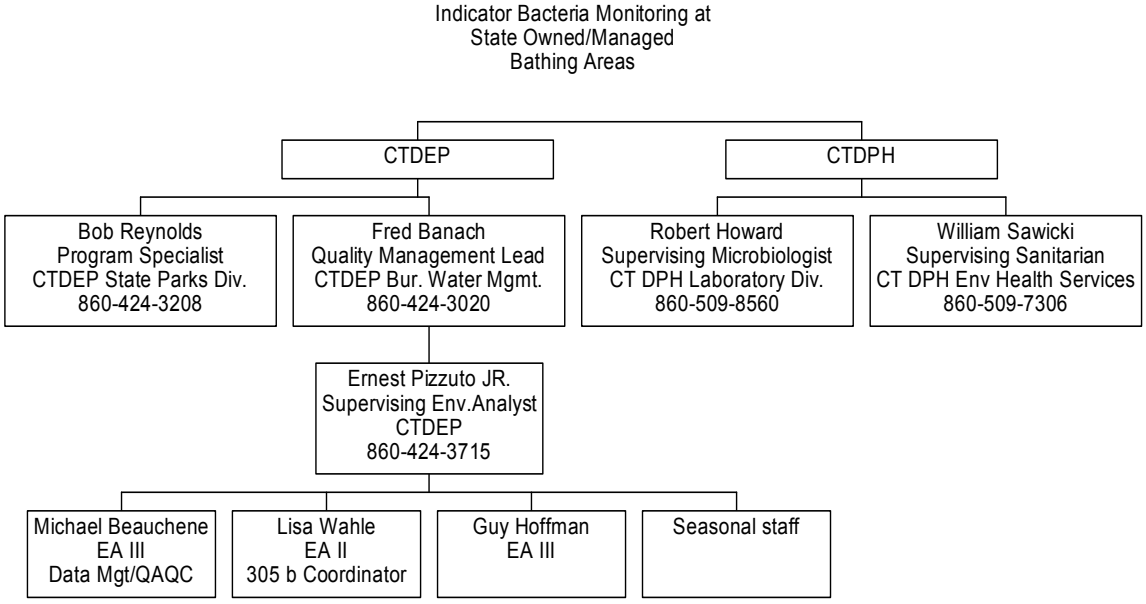
# 4. Project Organization

## 4.1 Organizational Chart




## 4.2 Communication Pathways

### A. State Beach Monitoring Program

Since two branches of the Connecticut Department of Environmental Protection (CT DEP) and two branches the Connecticut Department of Public Health (CT DPH) are involved in this project, efficient and timely communication is essential. The use of the telephone or interdepartmental email will be the primary tool for communicating between or within both agencies.

Closure decisions are ultimately the responsibility of the CTDPH under the authority of the Public Health Code.

Communication of closure status at State owned beaches to the general public is presently accomplished by updating the CT DEP web site and amending the State Beach "hotline" (860-424-3015). Updates are accomplished by DEP Parks or Office of Communications personnel the same day significant sample results are received from the CT DPH laboratory. CT DEP also issues press releases on the same day the laboratory results are received that are carried by area radio and television stations, and newspapers. Finally, the CT DPH immediately communicates the closure status of any state beach with appropriate local health officials by telephone or email.

Within one week of sample collection, the raw indicator bacteria data are electronically transferred from the CT DPH laboratory to the CT DEP monitoring Section via an FTP site. The data are then electronically uploaded into a Microsoft Access database maintained by the CT DEP monitoring Section.

A Beach Water Quality Fact Sheet is available and distributed to the general public on request or in response to inquiries by sampling personnel (Appendix A).

**B. Local Beach Monitoring Program**

Currently the primary communication pathway between the two state agencies and local health departments is by means of the annual beach sanitation meetings. This is particularly important for providing technical support, discussing laboratory and sampling procedures and promoting uniform monitoring methods and closure practices. The CTDPH also communicates directly with local departments regarding specific closure events or other significant incidents by telephone. A beach coordinator will be hired with funding from Section 406 (the Federal Beach Grant Program) to further enhance communication between state and local officials and with the public.

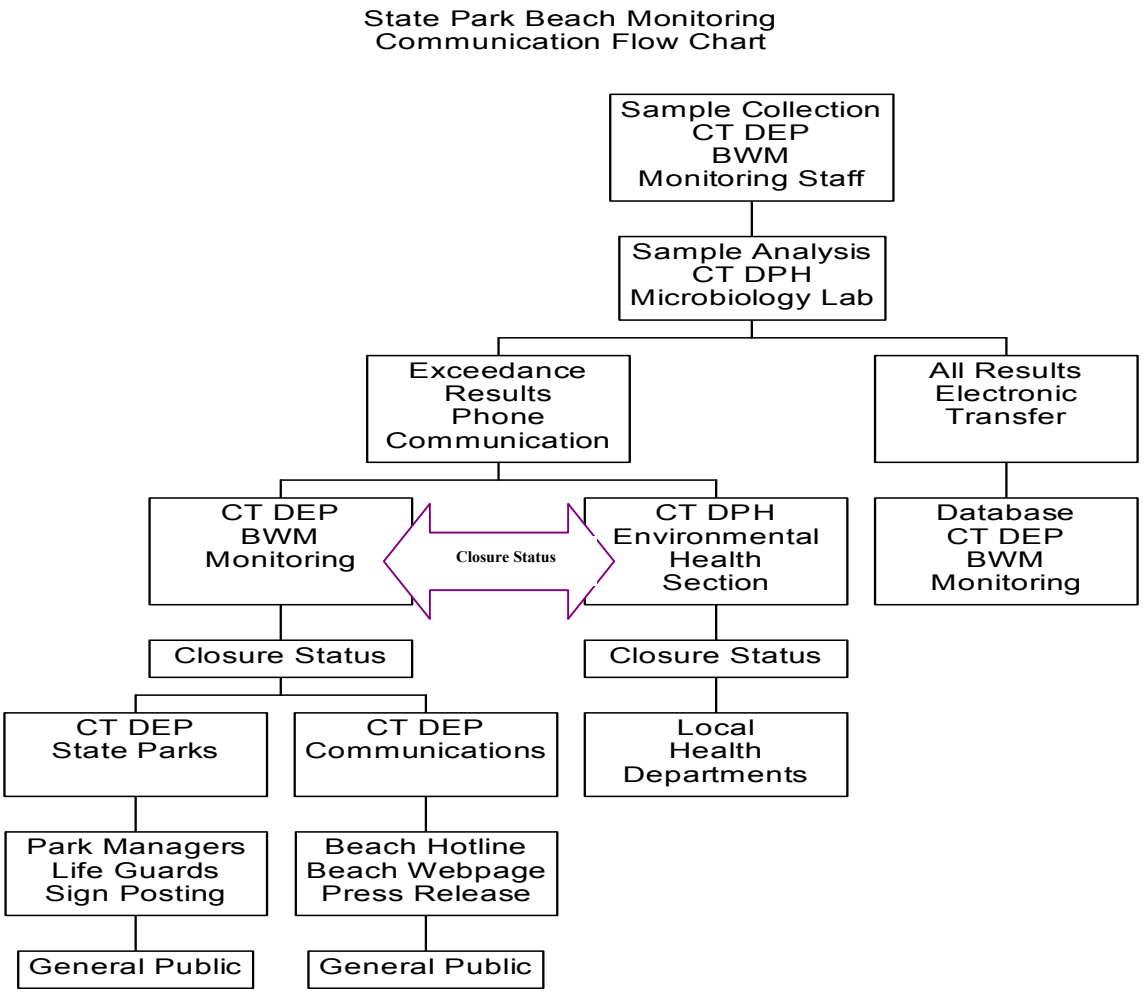



Figure 1. The state park beach monitoring communication flow chart.

### 4.2.1 Modifications to the Approved QAPP

This QAPP covers a data collection project that will be repeated seasonally on a yearly basis. Therefore it is intended to be in effect for a five-year period during which it will be reviewed internally on an annual basis. Any changes that will require modification to the approved QAPP will be documented and distributed via the above pathway. These modifications will be reviewed by all project personnel and then forwarded to the USEPA lab for comment, review, and approval.

## 4.3 Personnel Responsibilities and Qualifications

| Name | Responsibilities | Qualifications |
|---|---|---|
| Fred Banach<br>Assistant Director | Quality Management Lead<br>CT DEP<br>Bureau of Water Management | 10 years as Assistant Director of Planning and Standards Division. Over 25 years involved with water quality management. |
| Ernest Pizzuto Jr.<br>Supervising Environmental Analyst | Monitoring Program Supervisor<br>CT DEP<br>Bureau of Water Management | Registered Sanitarian, Over 25 years experience with water quality and biological monitoring. Supervisor of Monitoring Section for 5 years. |
| Robert Reynolds<br>Program Specialist | State Beach Management<br>CT DEP State Parks Div. | Over 25 years experience with state park management at field and administrative levels |
| Robert Howard<br>Supervising Microbiologist | Analytical Laboratory Supervisor<br>CT DPH Laboratory Div. | M.S. in microbiology, over 25 years experience with water quality testing. Laboratory supervisor for over 12 years. |
| William Sawicki<br>Supervising Environmental Sanitarian | Beach Closure Authority<br>CT DPH Environmental Health Section | Registered Sanitarian. B.A. in microbiology and chemistry. Over 30 years experience with water quality and biological monitoring in public swimming pools, shellfish |
| Michael Beauchene<br>Environmental Analyst III | Data Management/<br>QA-QC officer | Over 10 years involved with river/stream sampling. Developed Access database to store water quality and biological data. |
| Guy Hoffman<br>Environmental Analyst III | Monitoring Program Lead<br>CT DEP<br>Bureau of Water Management | Over 20 years involved with surface water quality and biological monitoring. |
| Lisa Wahle<br>Environmental Analyst II | Sec. 305 (b) Coordinator | Over 5 years experience in water quality monitoring. CT 305(b) coordinator. |
| Seasonal Field Staff | Sample Collection Crew | Active interest in pursuing a career related to water quality and or natural resource management. |

## 4.4 Special Training Requirements/Certification

**A. Training and Logistical Arrangements**

Training related to state beach monitoring including safety, sample collection, and laboratory preparation is handled by the Bureau of Water Management.

Training related to monitoring of local beaches under the Beach Grant currently consists of presentations by DEP/DPH personnel at the annual beach sanitation meeting that includes local directors of health and/or their staff. A Beach Grant coordinator will be hired with Beach Grant funding by the DPH during 2003. One of the duties planned for this person will be training local health officials and maintaining data quality for local beach monitoring conducted with Beach Grant funding.

**B. Description of Training and Trainer Qualifications**

Ernest Pizzuto, Supervising Environmental Analyst, is responsible for management of the state bathing beach monitoring program and directs training.

| Project Function | Course or Description | Trained by | Training Date | Trainees | Title | Certs/Records |
|---|---|---|---|---|---|---|
| Safety | First Aid/CPR | CT Fire Academy | Every 2 years | All Field Staff | All Field Staff | DEP personnel office |
| Safety | Sample Collection Safety | Bureau of Water Management | Every Spring | All Field Staff | All Field Staff | Bureau of Water Management |
| Safety | Defensive Driving | Bureau of Water Management | Every Spring | All Field Staff | All Field Staff | Bureau of Water Management |
| Safety | Laboratory Safety | Bureau of Water Management | Every Spring | All Field Staff | All Field Staff | Bureau of Water Management |
| Sample Collection | Sampling SOP | Bureau of Water Management | Every Spring | All Field Staff | All Field Staff | Bureau of Water Management |
| Analysis | Sample Preparation (Laboratory) | CT DPH Microbiologist | Every Spring | All Field Staff | All Field Staff | Bureau of Water Management |
| Data Management | Sample log-in procedure | Bureau of Water Management | Ongoing | All Seasonal Field Staff | All Seasonal Field Staff | Do Not Exist |

# 5. Project Planning/Problem Definition

## 5.1 Project Planning Meetings

**A. State Owned/Managed Beaches**

Project planning meetings are held in late winter or early spring and are attended by lead members from the CT DEP BWM and Parks; and CT DPH Environmental Health and the Microbiology Laboratory. Given the long history of this cooperative program, major changes are not usually necessary. The primary purpose of the meeting is to review communication pathways and address any problems or issues that were encountered during the previous sampling season. The QAPP is reviewed and prospective changes are discussed. A product of the annual planning meeting is a list of specific locations for weekly indicator bacteria sampling and possibly changes to the QAPP.

**B. Local Beaches Sampled under the Beach Grant**

The DEP and DPH have hosted annual beach sanitation meetings with health officials from coastal towns since 1989. These meetings have been held each spring in an effort to promote standard sampling and closure protocols and encourage use of the DPH Microbiology Laboratory by local health officials. In 2002 a fall meeting was also held and in an effort to enlist participation by local officials in the Section 406 Beach Grant Program. The spring 2003 meeting will continue this effort and also include a presentation on this QAPP.

## 5.2 Problem Definition/Site History and Background

The CT DPH conducted a near shore coastal indicator bacteria monitoring and evaluation program until 1989 when budget constraints and agency reorganization precluded the DPH from continuing the monitoring component of the program. Since 1988, the CT DEP Bureau of Water Management (BWM) has been involved in coordination of State Park beach monitoring with the CT DPH. In 1989 the BWM began monitoring indicator bacteria at the three State owned coastal beaches, all of which are located at CT State Parks. In 1989, the CT DEP adopted the EPA Enterococci criteria for designated bathing areas in the Connecticut Water Quality Standards. During the same year, the CTDEP and CT DPH in cooperation with local health officials developed and published "Guidelines for Monitoring Bathing Waters and Closure Protocol" (CT

DPHS, *et.al*. 1992). This document recommended the use of Enterococci as the indicator bacteria of choice for evaluating sanitary quality of both fresh and saltwater bathing areas and adopted the EPA Enterococci criteria for bathing waters. The document also proposed uniform methods for monitoring and evaluating sanitary quality. The "Guidelines" were revised in 1992 and are currently (2002) undergoing a third revision. The 2002 revision (as well as the current CT Water Quality Standards document) will retain the use of Enterococci for saltwater bathing areas but will recommend that *E. coli* be used for monitoring freshwater bathing areas. Criteria for both indicators are consistent with the 1986 EPA guidance (USEPA 1986).

Presently, the BWM conducts weekly monitoring for indicator bacteria at all state owned beaches. These include four coastal and seventeen inland beaches. The CT DEP Office of Communications is the lead agency for public service announcements related to beach closure. The CT DPH coordinates monitoring of municipal beaches performed by local public health officials. They also coordinate with local officials the results of beach monitoring at state beaches conducted by CT DEP. The CT DPH Microbiology Laboratory analyzes all indicator bacteria samples collected by CT DEP. The DPH laboratory will also analyze samples collected by local public health officials at no cost, and seasonally provides a courier service to pick up samples in order to facilitate use of the DPH Laboratory by local health departments for beach monitoring. In 2002 the courier service was funded under the Sec 406 Beach Grant Program.

The CT DPH Environmental Health Section provides technical support related to interpretation of indicator bacteria results for State or local beaches, and sponsors an annual meeting on beach sanitation each spring for local public health officials and CT DEP staff. Efforts are currently in progress to create a full-time beach grant coordinator position within the CT DPH EHS.

Indicator bacteria are used to predict the threat of waterborne illness by detecting potential contamination from fecal material of human or animal origin. However, due to inherent uncertainty involved with sampling and analytical determination of bacteria levels, excursions from established ambient criteria are investigated by means of a field survey of sanitary conditions or other appropriate means to determine sanitary quality (CT DEP 1997). Therefore actual beach closure is based upon professional judgement which considers the magnitude of the exceedance and the results of a sanitary survey of the watershed. These determinations are made jointly by the CT DPH and the CT DEP. Additional sampling is conducted within 24 hours following a criteria exceedance and continues until indicator levels are acceptable.

The established bacterial indicator for designated bathing waters in Connecticut is *Enterococci* for salt water. Samples should not exceed a criterion of 104 colonies per 100 ml for a single sample exceedance or a geometric mean of 35 colonies per 100 ml. based on 5 or more samples collected within a 30-day period. Beginning with the 2002 bathing season, *Escherichia coli* (*E. coli*) have been the bacterial indicator for designated bathing areas in freshwaters. *E. coli* samples should not exceed a criterion of 235 colonies per 100 ml. for a single sample or a geometric mean of 126 colonies per 100 ml based on 5 or more samples collected within a 30-day period (USEPA 1986).

# 6. Project Description and Schedule

## 6.1 Project Overview

### A. State Beach Monitoring Program

The CT DEP conducts weekly indicator bacteria sampling at 21 state-owned and managed swimming areas in order to assess the sanitary quality of the bathing waters. These swimming areas are distributed across 4 coastal parks–Rocky Neck, Hammonasset, Sherwood Island, and

Silver Sands and 16 inland parks- Black Rock, Burr Pond, Chatfield Hollow, Day Pond, Gay City, Hopeville Pond, Indian Wells, Kettletown, Lake Waramaug, Mashamoquet Brook, Mount Tom, Quaddick, Squantz Pond, Stratton Brook, Wadsworth Falls, Wharton Brook, and a state forest- Pachaug State Forest (Figure 2). Sampling for indicator bacteria commences the week prior to Memorial Day weekend and continues through the week preceding Labor Day. State Park bathing beaches are officially open for bathing between Memorial Day and Labor Day weekends.

Indicator bacteria are used to predict the threat of waterborne illness by detecting potential contamination from fecal material of human or animal origin. However, due to inherent uncertainty involved with sampling and analytical determination of bacteria levels, excursions from established ambient criteria are investigated by means of a field survey of sanitary conditions or other appropriate means to determine sanitary quality (CT DEP 1997). Therefore actual beach closure is based upon professional judgement which considers the magnitude of the exceedance and the results of a sanitary survey of the watershed. These determinations are made jointly by the CT DPH and the CT DEP. Additional sampling is conducted within 24 hours following a criteria exceedance and continues until indicator levels are acceptable. This process is described in "Guidelines for Monitoring Bathing Waters and Closure Protocol" (CT DPHS, *et.al*. 1992).

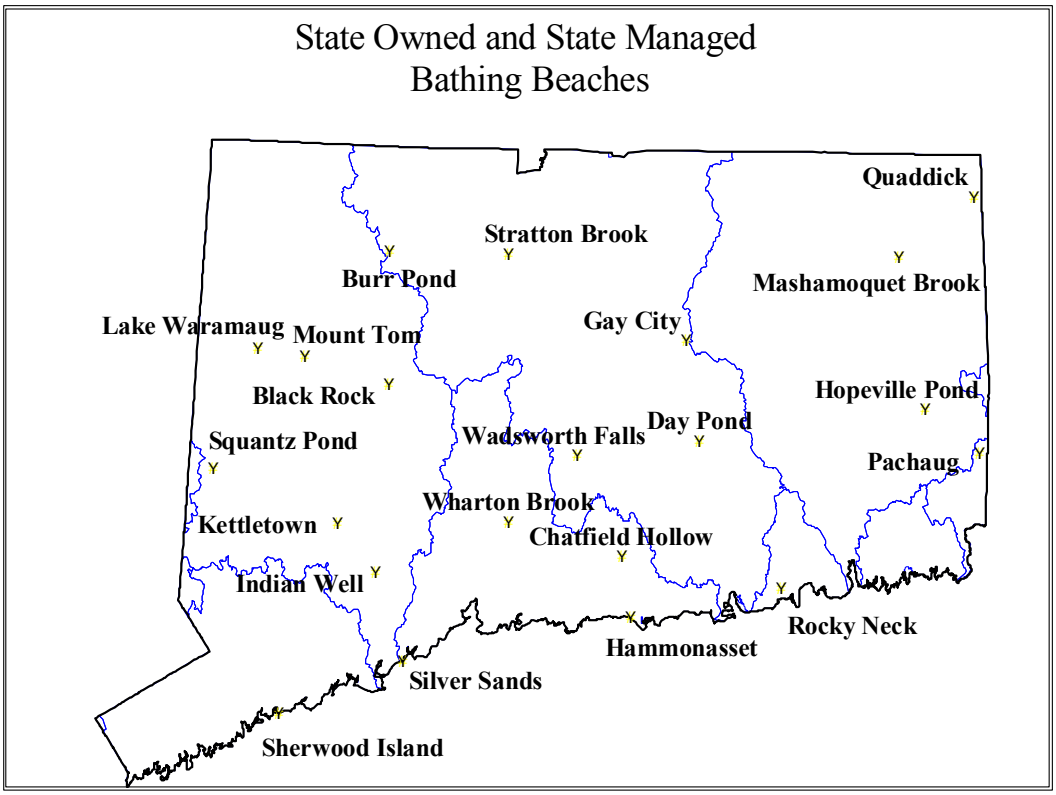



Figure 2. The location of the 21 State owned or State managed bathing areas.

**B. Local Beach Monitoring Program**
In addition to the 22 State owned bathing beaches there are 162 public beaches that are municipal or privately owned. Monitoring and closure practices at these beaches are the responsibility of local health authorities under the guidance of the CT DPH. The CT DEP/DPH encourages local health Departments to follow established guidance described in "Guidelines for Monitoring Bathing Waters and Closure Protocol" (CT DPHS, *et.al*. 1992). The CT DPH Laboratory Division also provides analytical services to any municipal director of Health at no cost to the municipality. A DPH courier service is available to transport samples to the DPH Laboratory. This service operates Monday through Thursday starting the week before Memorial Day and continuing through the week preceding Labor Day. In 2002 fifteen local health authorities utilized this courier service. Section 406 Beach Grant funds are being utilized to support the courier service and purchase laboratory supplies.

### 6.2 Project Schedule

The following table provides a schedule of the primary project activities for a typical monitoring season.

| Task | Date |
|---|---|
| Scoping Meeting/Review of Beach Locations | Spring |
| Annual State/Local Beach Sanitation Meeting | Spring |
| Training of Field Crew | Spring |
| Indicator Bacteria Collection | Weekly from the week prior to Memorial Day through Labor Day |
| Data entry/validation | Weekly from the week prior to Memorial Day through Labor Day |
| Data Evaluation/Assessment | Weekly from the week prior to Memorial Day through Labor Day |
| Data Reporting | Weekly from the week prior to Memorial Day through Labor Day Winter |
| Summary Report | Winter |

## 7. Project Quality Objectives and Measurement Performance Criteria

### 7.1 Project Quality Objectives

Data must be indicative of water quality conditions to adequately assess sanitary condition of the beach. Samples are collected at each side of the beach for inland parks and one sample every 1000 feet along coastal parks. In addition several upstream non-bathing areas are sampled where the potential for contamination from wildlife/runoff exists.

The established bacterial indicator for designated bathing waters in Connecticut is *Enterococci* for salt water. Samples should not exceed a criterion of 104 colonies per 100 ml for a single sample exceedance or a geometric mean of 35 colonies per 100 ml. based on 5 or more samples collected within a 30-day period. Beginning with the 2002 bathing season, *Escherichia coli* (*E. coli*) will be the bacterial indicator for designated bathing areas in freshwaters. *E. coli* samples should not exceed a criterion of 235 colonies per 100 ml. for a single sample or a geometric mean of 126 colonies per 100 ml based on 5 or more samples collected within a 30-day period (USEPA 1986).

## 7.2 Measurement Performance Criteria

**A. Precision & Accuracy/Bias**
A field duplicate is collected at 2 different sampling locations during each collection trip, and one sterile-water field blank is tested per trip. Consequently over 10% of samples per trip are QC samples. A relative percent difference (RPD) value of 100% is used as a precision threshold for field duplicates. The laboratory also tests one positive and one negative control on a daily basis. The data quality objective (DQO) for blanks is zero percent. An analytical method check is performed on each day of analysis. Positive control should be positive. Negative control should be negative. If these conditions are not met, the corresponding batch of data is invalidated. No laboratory duplicates are run.

**B. Data Representativeness**
Due to the patchy distribution of indicator bacteria in the environment, a minimum of 2 samples are collected from each bathing beach. Each set of samples from each beach is used to evaluate the sanitary condition of the water. Samples are collected at quarter points on each side of the beach for inland parks. At marine beaches the number of samples ranges from three to five depending on the linear distance of the beach. In addition, several upstream non-bathing areas are sampled where the potential for contamination from wildlife/runoff exists.

**C. Comparability**
Each sampling station is fixed and located by reference to a permanent landmark at each beach. The stations do not change throughout the sampling season. Each field crew is trained as to the location of each station and how to collect the sample.

**D. Completeness**
It is expected that at least two samples will be collected from each beach location weekly throughout the monitoring season with the addition of approximately 10% QC samples. It is expected that data will be reported from greater that 95% of the samples collected.

# 8. Sampling Process Design

## 8.1 Sampling Design Rationale

**A. State Beach Monitoring Program**
As one tool to evaluate the risk of waterborne illness to bathers, the CT DEP conducts weekly water sampling for indicator bacteria at 21 state-owned and managed swimming areas. These are located at 4 coastal parks - Rocky Neck, Hammonasset, Silver Sands and Sherwood Island; and 16 inland parks - Black Rock, Burr Pond, Chatfield Hollow, Day Pond, Gay City, Hopeville Pond, Indian Well, Kettletown, Lake Waramaug, Mashamoquet, Mount Tom, Quaddick, Squantz Pond, Stratton Brook, Wadsworth Falls, Wharton Brook; and 1 state forest - Pachaug State Forest.

Samples are collected at quarter points on each side of the beach for inland parks and one sample every 1000 linear feet for coastal beaches. This results in a minimum of two sampling locations for each State beach up to a maximum number of five. Individual sampling locations are geo-referenced using DGPS and the locations are stored in the DEP monitoring database which is linked to a geographical information system based on ArcView software. Water testing at state swimming areas begins the week before Memorial Day weekend and continues through Labor Day weekend. The beaches are organized geographically into four trips; southwest, southeast, northwest, and northeast. There are two samplers per trip, two trips are sampled per day. The southwest and

southeast trips include the coastal beaches and are sampled on Mondays. The northwest and northeast trips are sampled on Tuesdays. Two field duplicates and a field blank are collected on each trip. A total of 49 routine state beach samples are collected each week along with 8 duplicates and 4 blanks. Re-samples may be collected throughout the week as needed.

Water samples from the 21 state-owned swimming areas are analyzed at the CT Department of Public Health Laboratory. Samples are analyzed for indicator bacteria, which are not disease causing pathogens, but can indicate the presence of fecal contamination.

Sample design logistics are shown in Table A, and sampling trip organization in Table B.

**Table A. Sample Design Logistics**

| Category | Type of sample | Number of samples | Sampling Frequency | Sampling Period |
|---|---|---|---|---|
| Indicator Bacteria | Grab | 2 (up to 5 samples depending on the linear distance of the beach) | Weekly/retest as necessary | Week prior to Memorial Day Weekend through Labor Day Weekend |

**Table B. Sampling Trip Organization, State Beaches**

| Beach Name | Beach ID Code | Number of Samples |
|---|---|---|
| **Southwest Trip (Monday)** | | |
| Wharton Brook | WBK | 2 |
| Silver Sands | SSSP | 3 |
| Sherwood Island | SISP | 3 |
| Kettletown | KTLT | 2 |
| Indian Well | INWL | 2 |
| **Southeast Trip (Monday)** | | |
| Chatfield Hollow | CHH | 2 |
| Day Pond | DYP | 2 |
| Rocky Neck | RNSP | 4 |
| Hammonasset | HSP | 5 |
| Wadsworth Falls | WWF | 2 |
| **Northwest Trip (Tuesday)** | | |
| Black Rock | BLKR | 2 |
| Burr Pond | BRRP | 2 |
| Lake Waramaug | LKW | 2 |
| Mount Tom | MTT | 2 |
| Stratton Brook | STRB | 2 |
| Squantz Pond | SQPD | 2 |
| **Northeast Trip (Tuesday)** | | |
| Gay City | GYC | 2 |
| Hopeville Pond | HVP | 2 |
| Mashamoquet Brook | MMB | 2 |
| Quaddick | QDK | 2 |
| Pachaug SF | PSF | 2 |

**B. Local Beach Monitoring Program**

Currently local health departments are encouraged to follow the sampling and closure protocols developed by the DEP and DPH in 1989, much of which has been incorporated into this QAPP. Communication has primarily been accomplished by means of annual meetings between the State

agencies and local health departments. Consequently, the level of compliance with issues like sample holding times, number of QA samples, etc. for local beach monitoring programs is unknown. Beginning with the 2003 bathing season, local health departments who utilize the DPH courier system or otherwise participate in the Beach Grant Program will be required to follow this QAPP. A full-time beach monitoring coordinator will be hired by the DPH under the Beach Grant Program in 2003. Training and coordination with local health departments, as well as compliance with the QAPP will be part of the job description for this employee.

# 9. Sampling Procedures and Requirements

## 9.1 Sampling Procedure

Follows standard sampling procedure for beach monitoring (Appendix B).

## 9.2 Sampling SOP Modifications

None

## 9.3 Cleaning and Decontamination of sampling containers

Samples are collected in 125 ml. rigid plastic bottles. The DPH provides sample collection bottles for all samples submitted to that laboratory. These bottles are sterilized by the CT DPH at 121ºC for 30 minutes. Each batch of sample containers is checked for sterility. At least one container per 25 containers sterilized is checked by adding 25 ml of trypticase soy broth to each bottle. Bottles are incubated for growth at 35 ºC for 24 hours and checked for growth. The batch is rejected if any contamination is found in any of the bottles tested

If a bottle is contaminated during the sample collection process it is discarded and replaced with a new sterile bottle.

## 9.4 Field Equipment Calibration

No field equipment that requires calibration is used in this monitoring project.

## 9.5 Field Equipment Maintenance, Testing and Inspection Requirements

No field equipment that requires maintenance, testing and inspection is used in this monitoring project.

## 9.6 Inspection and Acceptance Requirements for Supplies/Sample Containers

The DPH provides sample collection bottles for all samples submitted to that laboratory. These collection bottles are sterilized by the CT DPH. Inspection/acceptance and QA of these sterile containers are conducted at the DPH Lab. prior to acquisition by CT DEP staff. No field equipment is used in this monitoring project. See section 9.3 above.

# 10.Sample Handling, Tracking and Chain of Custody Procedures

Sample bottles are labeled with the site number, date, and time of collection immediately prior to collection. The samples are placed in a cooler on ice for transport to the lab. A field data sheet is filled in with the site number, collection date, collection time, collector, recent weather conditions, 24-hour prior rainfall, tide, general beach condition, and qualitative assessment of bird activity (Appendix C).

The field data sheet is submitted with the samples at the DPH Laboratory receiving room where a unique laboratory identification number (accession number) is assigned to each sample. This unique number is attached to both the sample bottle and the field data sheet by means of an adhesive label that contains both the number and a bar code. The field data sheet also receives a time stamp at the receiving room. The sheet serves as a sample invoice and chain of custody form

As soon as the above process is completed the collector brings the samples to the microbiology lab. At the lab the samples are logged on a daily sample log sheet and the collector prepares the samples for analysis. The set-up time is also recorded.

Every effort is made not to exceed the six-hour holding time. Each electronic sample record contains the time and date of collection, time delivered to the laboratory and time the test was set up. This allows the data to be screened and flagged for exceedance of holding time.

### 10.1 Documentation and Records

### 10.1.1 Field Notes

Field Data sheets track information as recommended in section 10.1.1 (USEPA 1999). In addition, recent weather conditions, 24-hour prior rainfall, tidal stage, general beach condition, debris and qualitative assessment of bird activity are recorded.

### 10.1.2 Field Documentation Management System

Field data sheets including CT DPH sample accession number are entered into a Microsoft Access Database within 3 hours of returning to the lab.

### 10.2 Sample Handling and Tracking System

Samples are tracked using the CT DEP site number until the samples are submitted to CT DPH. At this point the CT DEP site number and the CT DPH accession number are used to track the sample through the analytical process.

### 10.3 Sample Custody

Samples remain in the custody of the collector until they are placed into the incubator at which time the CT DPH microbiology laboratory is responsible for custody of the samples.

## 11. Field Analytical Requirements

No field analyses are required for this monitoring project.

## 12. Fixed Laboratory Analytical Method Requirements

Analytical methods used for enumeration of Enterococci and *E. coli* are Enterolert and Colilert respectively (IDEXX Laboratories Inc., Westbrook, Maine). These are semiautomated, multiple well, most probable number methods that have been determined to be equivalent methods to the mE and modified mTEC methods recommended by USEPA (Budnick et al. 1996, 2002).

| Method | Container Size | Holding Time | Dilution | Detection Limits |
|---|---|---|---|---|
| Enterolert | 125 ml. | 6 hours | 1:10 | < 10 --- > 2,000 |

## 13. Quality Control Requirements

### 13.1 Sampling Quality Control

A senior staff member accompanies field-sampling crews on several occasions throughout the summer to insure samples are collected at the correct location and according to the sampling SOP.

### 13.2 Analytical Quality Control

All analytical quality control is the responsibility of the CT DPH Microbiology Laboratory. The USEPA and the US FDA audit the CT DPH Microbiology Laboratory every three years. Two field duplicates and one field blank are submitted for each sampling trip.
The laboratory also tests one positive and one negative control on a daily basis. The data quality objective (DQO) for blanks is zero percent.

Each lot of reagent is tested for autofluorescence by adding 100 ml of sterile water to a sterile vessel. After the reagent is dissolved the mixture is checked with a UV light. If reagent exhibits faint fluorescence, the reagent lot is unacceptable.
Each lot of reagent is tested for sterility on receipt by adding 100 ml of sterile distilled water to a sterile vessel. Reagent is added, shaken to mix and incubated at $35^0C \pm 0.5^0C$ for 24 hrs then checked for growth. If growth is present, the lot is rejected.
Each lot of reagent is tested when received with positive and negative controls. If the controls do not test correctly the lot is rejected.

## 14. Data Acquisition Requirements

Indicator bacteria data are automatically posted on the State of Connecticut FTP site every Monday by the CTDPH Laboratory. These data are in comma delimited format and are uploaded directly into a Microsoft Access Database. Hard copy data reports are sent to the project data manager.

## 15. Documentation, Records, and Data Management

### 15.1 Project Documentation and Records

| Sample collection records | Field Analysis Records | Fixed Laboratory Records | Data Assessment Records |
|---|---|---|---|
| **Field Notes, Collection date/time, collector, tidal stage, bird activity, general beach condition** | **none** | **Accession number<br>Analyst<br>Received date/time<br>Prep date/time<br>Report date/time<br>Analytical method** | **Photocopies of field sheets with accession numbers (sample invoices), hard copies of data reports.** |

### 15.2 Field Analysis Data Package Deliverables

None

### 15.3 Fixed Laboratory Data Package Deliverables

Hard copies of the sample results are reported to the project data manager. Electronic data transfer is via the state FTP site.

### 15.4 Data Reporting Formats

Data are reported as most probable number of Enterococci colonies per 100 milliliters and most probable number of Escherichia coli colonies per 100 milliliters.

A written report is produced annually at the completion of the bathing season. A table listing all beach closures is prepared annually as required by Sec. 305(b) of the Clean Water Act.

## 15.5 Data Handling and Management

**Data Recording**

Hard copies of the sample results are reported to the project manager. Electronic data transfer is via the state FTP site.

**Data Transformation/Data Reduction**

Data reduction and summary statistics are performed using MS Access or Excel software applications. These data will ultimately be uploaded to the USEPA STORET database.

**Data analysis and Data Assessment**

The established bacterial indicator for designated bathing waters in Connecticut is *Enterococci* for salt water. Samples should not exceed a criterion of 104 colonies per 100 ml for a single sample exceedance or a geometric mean of 35 colonies per 100 ml. based on 5 or more samples collected within a 30-day period. Beginning with the 2002 bathing season, *Escherichia coli* (*E. coli*) will be the bacterial indicator for designated bathing areas in freshwaters. *E. coli* samples should not exceed a criterion of 235 colonies per 100 ml. for a single sample or a geometric mean of 126 colonies per 100 ml based on 5 or more samples collected within a 30-day period (USEPA 1986). Data analysis consists primarily of calculating exceedance frequency for single sample maximum and geometric mean values.

## 15.6 Data Tracking and Control

The laboratory results are transmitted electronically from the DPH to the DEP. A comma delimited text file is read into a Microsoft Access database. This database was developed and is maintained by BWM staff. The database resides on a Novell Computer local area network. The CT DEP Information Technology Section maintains this network. The network is backed up nightly, weekly, monthly, and annually on computer tapes. With this back up system the database can be restored following catastrophic loss or corruption. Ultimately these data will be uploaded to the USEPA STORET water quality database.

The database is password protected and maintained by Mike Beauchene. Only he and Ernest Pizzuto, the monitoring supervisor, know the password. The monitoring supervisor keeps a hard copy of the password. All other Monitoring Section and some Planning Division staff have read-only access to the database.

# 16. Assessment and Response Actions

## 16.1 Planned Assessments

The primary purpose of this monitoring program is to evaluate the sanitary quality of bathing waters at State owned beaches in Connecticut. Sample results are available the day following collection. Upon completion of bacterial analyses, the laboratory supervisor or a senior microbiologist review the data and flag any values that exceed the one-sample maximum. They then notify a supervising sanitarian in the CTDPH Environmental Health Section and a supervising environmental analyst in the CTDEP Monitoring Section by telephone. The sample location, beach name and indicator value are reported for each exceedance. Following notification, DPH and DEP staff discuss the exceedance information and reach a consensus on closure and/or resample actions. If it is necessary to close one or more beaches the DEP monitoring supervisor then contacts the DEP Parks Division and DEP Communications Office by telephone and email. They take appropriate actions to close state beaches and initiate the public notification process. DEP monitoring staff then schedule resampling for the following day as needed. The DPH Sanitarian notifies local health officials of any State beach closure actions within their jurisdiction. A voice-mail message is recorded if direct contact is not made at any

point in the above sequence. If the caller does not receive a call back within an hour to acknowledge the voice-mail, subsequent calls are made to alternative staff according to a predetermined sequence until a an appropriate person is contacted directly.

### 16.2 Assessment Findings and Corrective Action Responses

Closure status is tracked constantly during the bathing season in the beach monitoring (MS Access) database. Beaches subject to chronic closure are scheduled for watershed sanitary surveys. Field personnel from the Permits, Enforcement and Remediation Division of the DEP Bureau of Water Management normally conduct the sanitary surveys. Supplemental monitoring for indicator bacteria or optical brighteners is conducted by the Ambient Monitoring Section.

### 16.3 Additional QAPP non-conformances

The monitoring staff and the field crew supervisor discuss and reach consensus regarding any field sampling deviations. When duplicate sample RPDs exceed 100% the first step is to review the field notes and/or query the sample collector to ensure that adverse field conditions did not cause the problem. The DPH laboratory is also consulted to check on the results of laboratory blanks that correspond to the subject samples. Non-conformance with DQOs for laboratory controls results in invalidation of the corresponding batch of data. Corrective actions are decided and based upon the intended use of the data. If it is determined that conditions will jeopardize the usability of the data sampling is suspended until the issue can be resolved according the communication pathways described in section 4.2.

## 17. QA Management Reports

An overview of all QA issues is prepared at the end of the sampling season and distributed to all appropriate monitoring staff and stakeholders.

## 18.Verification and Validation Requirements

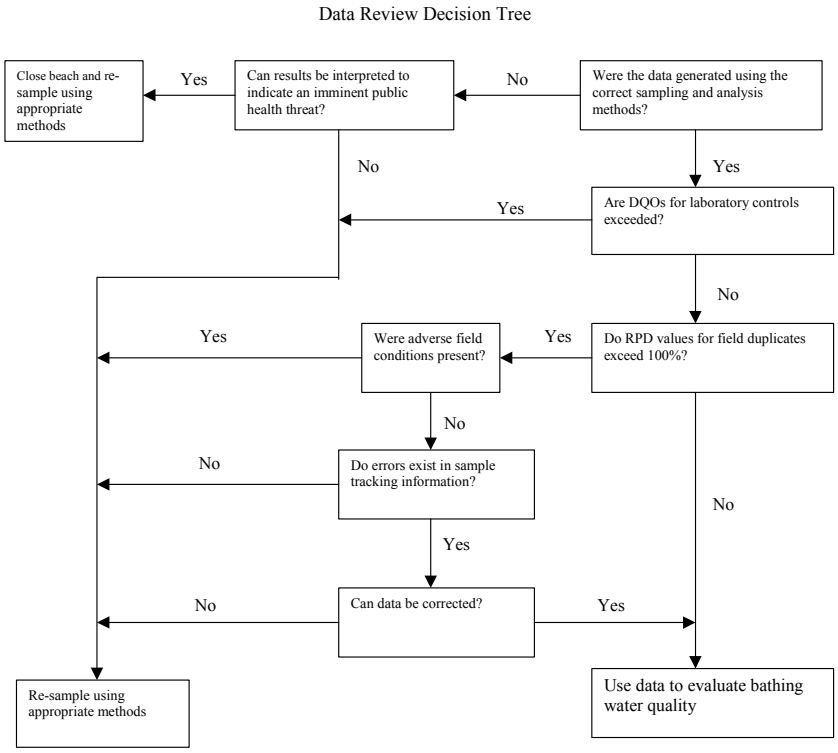
Weekly verification of the information in the database versus the hard copy report is required.

## 19.Verification and Validation Procedures

The data manager generates a report of sampling results and metadata the week following sample collection. This report contains all field collection information as well as the reported data for indicator levels. The sample collectors using the original field sheets and hard copy data report review the information on each report. Any discrepancies are reported to the QA officer. Any discrepancies are noted and resolved based on the hard copy report by the QA officer. The CT DPH Senior Microbiologist resolves any questions regarding the hard copy report.

# 20. Data Usability/Reconciliation with DQO's

Data are reviewed according to the Data Review Decision Tree Diagram shown below.



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**Appendix A**

STATE OF CONNECTICUT
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106

WATER QUALITY
INFORMATION LINE
(860) 424-3015

**STATE SWIMMING AREA WATER QUALITY SUMMER PROGRAM**
**FACT SHEET**

**Background**

- The Department of Environmental Protection (DEP) conducts weekly sampling at 21 state-owned and managed swimming areas: 4 coastal parks - Rocky Neck, Hammonasset, Silver Sands and Sherwood Island; 16 inland parks - Black Rock, Burr Pond, Chatfield Hollow, Day Pond, Gay City, Hopeville Pond, Indian Well, Kettletown, Lake Waramaug, Mashamoquet, Mount Tom, Quaddick, Squantz Pond, Stratton Brook, Wadsworth Falls, Wharton Brook; and 1 state forest - Pachaug State Forest.

- Water testing at state swimming areas begins the week before Memorial Day weekend and continues through Labor Day weekend.

- Samples from the 21 state-owned swimming areas are analyzed at a Department of Public Health lab. Samples are analyzed for indicator bacteria, which are not disease causing pathogens, but are one of the tools used by public health and environmental protection officials to evaluate the potential contamination of waterbodies.

**State Swimming Area Water Quality Report**

- The weekly report lists the location and status of DEP's 21 inland and coastal swimming areas.

- Prepared weekly, the report is issued every Thursday afternoon. If a problem is indicated, DEP and DPH can resample and have results available in 24 hours.

**Swimming Area Information Line and DEP web site**

- The DEP State Parks Division maintains a 24-hour “State Parks Swimming Area Water Quality Status” information line. By dialing **(860) 424-3015** the public and the media can check the status of Connecticut's 21 state-owned swimming areas. The Information Line provides up-to-date information through a recorded message. In the event a swimming area is closed, the message indicates alternative swimming locations.

- The results are also posted on DEP's web site at http://dep.state.ct.us. Visitors to the web site will find the state swimming area information by clicking on the "Environmental and Health Updates" button.

For further information, contact Matt Fritz of the Connecticut DEP at 424-4100.

## Appendix B

## Standard Sampling Procedure for Beach Monitoring

### 1) SAMPLE BOTTLES

- All Beaches: use sterile nalgene plastic bottle marked 125ml / 4 oz on the bottom.

### 2) PROCEDURE

- Select sample location (see attached map)
- Record date, time, and site number on the bottle.
- Wade out to a depth of about 3 feet
- Hold bottle by bottom. Uncap bottle, be careful not to touch inside of cap or mouth of bottle.
- Hold bottle by bottom. Facing away from shore, sweep the bottle downward into the water (approximately elbow deep) and away from your body. **Fill 1/2 to 3/4 full.**
- **It is important to leave an airspace of approximately 1-inch in the bottle. If the bottle is full, immediately pour off 1 inch of the sample.**
- Cap the bottle tightly without touching the inside of the cap, or mouth of the bottle.
- Place the bottle on ice until delivered to the CT DPH laboratory.
- Record date, time, location and samplers name on field sample form. (See attached map for sample location numbers)

## Appendix C

STATE OF CONNECTICUT
DEPARTMENT OF PUBLIC HEALTH
BUREAU OF LABORATORIES

P.O. Box 1689 Hartford,CT 06144
Telephone: (860) 566-2717

Date Received

**MICROBIOLOGICAL EXAMINATION OF BATHING WATER SAMPLES**

DATE COLLECTED

Account Label ↓ Weather Condition:

A00159/DEP
DEP-BUREAU OF WATER MGT/MONITOR
E. Pizzuto - Rec. Water
79 Elm Street
Hartford, CT 06106

Collect by: _____
Town: (140) Thomaston, (74) Litchfield, (114) New Preston

**SAMPLE OF BATHING WATER**

| | | |
|---|---|---|
| Location: 36 **BLKR-1** | Accession No. _____ | 559W |
| Time: _____ | Collector's No. _____ | |
| Rainfall: _____ | Enterococci Count/100 ml _____ | |
| Tide: Birds: | | |

| | | |
|---|---|---|
| Location: 37 **BLKR-2** | Accession No. _____ | 559W |
| Time: _____ | Collector's No. _____ | |
| Rainfall: _____ | Enterococci Count/100 ml _____ | |
| Tide: Birds: | | |

| | | |
|---|---|---|
| Location: 21 **MTT-1** | Accession No. _____ | 559W |
| Time: _____ | Collector's No. _____ | |
| Rainfall: _____ | Enterococci Count/100 ml _____ | |
| Tide: Birds: | | |

| | | |
|---|---|---|
| Location: 44 **MTT-2** | Accession No. _____ | 559W |
| Time: _____ | Collector's No. _____ | |
| Rainfall: _____ | Enterococci Count/100 ml _____ | |
| Tide: Birds: | | |